









Future of Nuclear Energy

Kemal Pasamehmetoglu
Nuclear Science and Technology
Associate Laboratory Director

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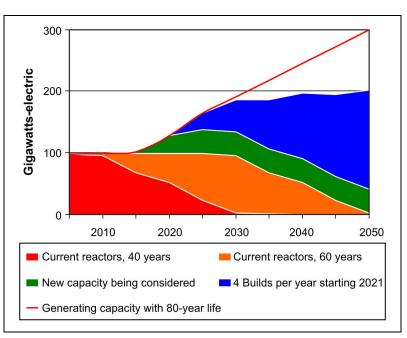


Nuclear Energy in the U.S.



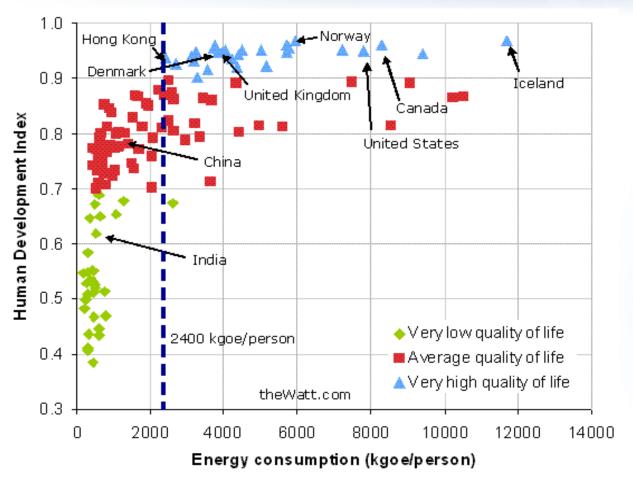
- 104 reactors in 31 states
- 4 new nuclear plants under construction
- 22 early site permits
- Providing 20% of our electricity
- 69% carbon free generation

- 71 reactors with 20 year license extensions, 32 with pending extensions
- 140 power uprates, 20 more under review. Equivalent to about six new reactors
- 23 commercial reactors have shut down





Nuclear Energy in the Rest of the World





There are 66 commercial plants being built world-wide and only four of those are in the U.S.

440 Reactors Worldwide (104 of those are in the U.S.)



Factors for Change

- Increase demand for electricity 22% increase in the U.S. by 2035
- Concern about carbon emissions
- Cost of energy and its impact on economic competitiveness
- Costs, risks and environmental impacts of nuclear energy and its alternatives
 - Baseload power
 - Fukushima







Factors for Change in the U.S.

Helpful to Nuclear Energy

- 4 new plants under construction in 2 states
- 9 license extensions approved (post Fukushima)
- Blue Ribbon Commission may resolve the Yucca Mountain impasse
- U.S. reactors evaluated as safe (post Fukushima)

Not Helpful to Nuclear Energy

- Low natural gas prices, anticipated very large supply
- Financial turmoil and recession
- Fukushima's impacts on public opinion and cost of related regulations
- NRC uncertainty
- No effort to put a price on CO₂ emissions
- Lack of a long-term view
- Demonizing and romanticizing technology

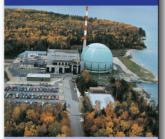






Reactor Technologies — Past, Present and Future

Generation I



Big Rock Point, GE BWR

Early Prototypes

- · Calder Hall (GCR)
- Douglas Point (PHWR/CANDU)
- Dresden-1 (BWR)
- · Fermi-1 (SFR)
- Kola 1-2 (PWR/VVER)
- Peach Bottom 1 (HTGR)
- Shippingport (PWR)

Generation II



Diablo Canyon, Westinghouse PWR

Large-scale Power Stations

- Bruce (PHWR/CANDU)
- · Calvert Cliffs (PWR)
- Flamanville 1-2 (PWR)
- Fukushima II 1-4 (BWR)
- Grand Gulf (BWR)
- Kalinin (PWR/VVER)
- Kursk 1-4 (LWGR/RBMK)
- Palo Verde (PWR)

Generation III / III+



Kashiwazaki, GE ABWR



AP1000, Westinghouse PWR

Evolutionary Designs

(Economics, Safety, Scalability, Process Heat)

- ABWR (GE-Hitachi; Toshiba BWR)
- ACR 1000 (AECL CANDU PHWR)
- AP1000 (Westinghouse-Toshiba PWR)
- APR-1400 (KHNP PWR)
- APWR (Mitsubishi PWR)
- Atmea-1 (Areva NP -Mitsubishi PWR)
- · CANDU 6 (AECL PHWR)

- EPR (AREVA NP PWR)
- ESBWR (GE-Hitachi BWR)
- Small Modular Reactors
- Atomenergoproekt PWR
- B&W mPower PWR
- India DAE AHWR
- KAERI SMART PWR
- NuScale PWR
- Westinghouse IRIS PWR
- VVER-1200 (Gidropress PWR)
- NGNP (Next Generation Nuclear Plant)

Generation IV



Japan Sodium Fast Reactor

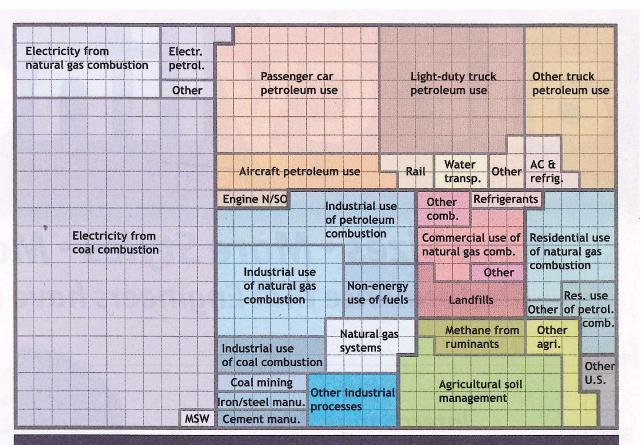
Revolutionary Designs (Economics, Safety, Fuel Utilization, Waste Management,

- GCR Gas-Cooled fast Reactor
- LFR Lead-cooled Fast Reactor
- MSR Molten Salt Reactor
- SFR Sodium-cooled Fast Reactor
- SCWR Super-Critical Watercooled Reactor
- VHTR Very High Temperature Reactor

1950 1970 1990 2010 2030 2050 2070 2090



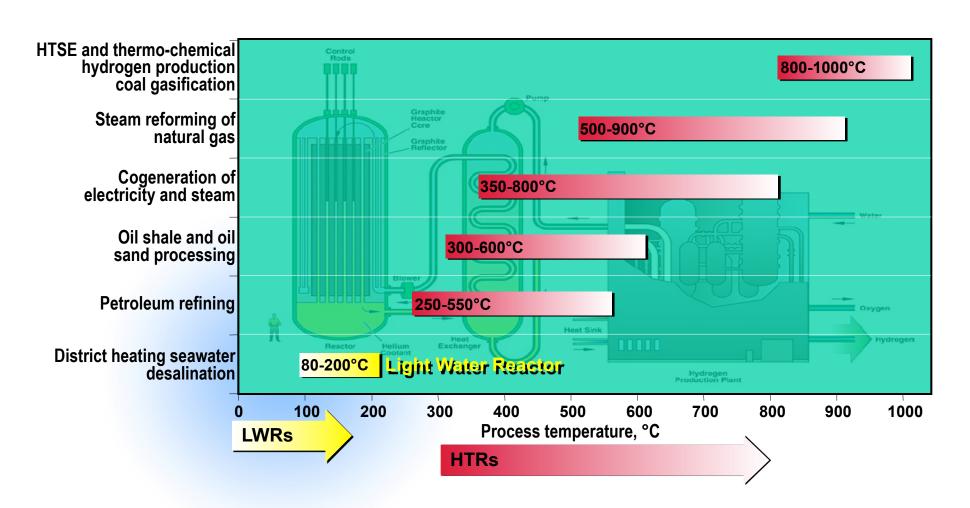
2007 Sources of Greenhouse Gas Emissions



 \triangle Derived from a 2007 U.S. EPA report, this chart breaks down the annual U.S. emissions of green-house gases by source. Each of the 726 squares represents the equivalent of 10 million tons of CO $_2$.



Nuclear energy can reduce greenhouse gases beyond the electricity sector



Fuel Cycle Technologies

